For Dr. David Boyce
with kind compliments
from his friend R. Grant.

AN ESSAY

ON THE

STUDY OF THE ANIMAL KINGDOM.

BEING AN

INTRODUCTORY LECTURE

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INTRODUCTORY LECTURE.

GENTLEMEN,

THE object of this Course of Lectures is to demonstrate the structure of Animals, to explain their Functions, to detail their History and Uses, and to illustrate the principles of their Classification.

These subjects constitute the departments of Physical Science, termed Comparative Anatomy or Zootomy, Comparative Physiology, and Zoology, which treat of the forms, the mechanism, the properties, the phenomena, and the relations of all the existing and extinct species of Animals known upon this earth.

The word Zootomy (derived from ζωον, an *animal*, and τεμνειν, *to cut*,) is employed to express the knowledge acquired by dissecting the bodies of animals. This science makes us acquainted with their organization, or with the structure and form of all their internal parts and organs. It points out the connections which subsist between the different parts of the animal machine, by which they are all enabled to co-operate towards the same great objects—the preservation of the individual, and the continuance of the race. It examines the changes which the organs undergo at different periods of life, to suit them for the various stages of infancy, maturity, and decay. It traces the modifications of form and structure presented by the different organs and parts of the machine, in all the inferior tribes of animals, by which the whole organization of the species is always admirably adapted to the circumstances in which they are placed.

It points out the regular gradation in the forms of indi-

vidual organs, from their highly complicated and elaborate structure in Quadrupeds, to their simplest forms, and their total disappearance in the lower orders. It shows that, notwithstanding the highly complicated organization we observe in the more perfect animals, and the intimate connexion which subsists between all their parts, not one of all their organs is universal in the Animal Kingdom, or essential to the phenomena of animal life. The whole skeleton, the solid frame-work of the body, destined to give strength, form, and support to the entire machine, disappears in the class of Molluscous Animals,—as in the *Doris*, *Tritonia*, *Eolis*, &c. The muscular system, so essential to all the voluntary and involuntary movements of the higher classes, entirely disappears in the class of Radiated Animals, and with it every trace of nervous system which we are apt to suppose essentially connected with all the motions and functions of animals. The brain, so intimately connected with the phenomena of mind, after dwindling into the form of a few separate ganglia placed on the œsophagus, and connected only with the function of digestion, disappears from the Animal Kingdom. The heart, the great centre of the circulation, after diminishing successively the number of its cavities, from four to one, in the higher classes of animals, disappears among insects. The blood-vessels also cease to exist, and, with them, all circulating motion of the blood, as in most Radiated Animals, and in the whole class of Zoophytes. The function of respiration is intimately connected with the circulation of the blood, and its organs, after undergoing various modifications of form, suited to the different media in which the animals live, cease to belong to the system. Although the function of secretion is performed by animals very low in the scale, all distinct glandular organs for its performance are lost long before the total disappearance of an internal digestive cavity. Many of the lowest Zoophytes, which have no internal digestive sac, and no polypi (which are only superficial digestive cavities,) absorb their

whole nourishment by the surface of their body, or by the parietes of canals which traverse their interior. The simplest gelatinous animalcules, which possess no internal cavity, are also reduced to superficial absorption, and thus form a transition to the mode of nourishment of the vegetable kingdom.

Besides describing the structure of all the inferior animals, and the changes which the organs and textures undergo at different periods of life, this branch of Anatomy examines the nature of the metamorphoses which various classes of animals undergo before arriving at their perfect state. And by comparing the adult organs of the inferior classes, with the embryo state of the same organs in the higher orders of animals, many extraordinary analogies are discovered, which throw much light on the functions of the parts, and serve to unravel the most complicated and difficult forms of organization. By tracing back, for example, the skeleton of fishes to that of quadrupeds and man, the true nature and uses of all their complicated arrangement of osseous parts have been discovered and ascertained. And by comparing the human brain in the earliest stages of its developement, with the permanent forms of that organ in quadrupeds, birds, reptiles, and fishes, the most singular resemblances have been discovered, which throw a new light on the gradual developement of that organ in the most perfect animals, and on its remarkable structure in the inferior classes.

By prosecuting these various enquiries, the views of the Anatomist become enlarged, the speculations of the Physiologist are corrected or extended, and new principles are discovered for the scientific arrangement of the Animal Kingdom.

Of all animals Man has the most elaborate and complicated organization, and the structure of his body has been a subject of constant observation and study, since the infancy of the human race. Though debarred from human dissection by superstition in the earliest times, the prac-

tise of physic and surgery, the process of embalming, the catastrophes of the field of battle, the accidents of common life, and the natural curiosity of man, as well as the constant habit of examining the structure of the inferior animals, had made men acquainted with the leading facts of human Anatomy before the period of Aristotle, who raised it to the dignity of a science, and all his successors have endeavoured to extend its bounds. The great body of knowledge respecting his internal economy, accumulated from the experience of so many ages, now forms the subject of many separate branches of science, the details of which are conducted with great learning and ability by my distinguished Colleagues in this Institution. The structure and functions of the human body are therefore objects of attention in this place only as the standards of comparison, from which we trace the modifications of form throughout all the lower classes of the Animal Kingdom. We compare the organs of the inferior animals with the similar organs of man, to determine the extent of their deviation, and by watching the result of this change of structure, important light is thrown on the functions of the various parts. In animals far distant in the zoological scale, where similar organs no longer exist, we discover analogies of use between parts totally dissimilar in structure, which point out their uses in the economy, and mutually illustrate their functions. From the comparisons thus constantly instituted in all zootomical enquiries, this science has been denominated Comparative Anatomy.

Comparative Physiology treats of the functions of the lower animals. It considers the organs in a state of action, and determines the purposes they are destined to serve in the living economy. It makes us acquainted with the uses of all the parts of the inferior animals, and investigates the physical causes of all the vital phenomena they exhibit. It enquires into the means by which the various motions of animals are effected, whether of the whole body from place to place, or of voluntary or involuntary parts.

It examines into the circumstances which modify their sensations and preceptions, and discovers the sources of their peculiar instincts and habits. It describes the various modes in which the functions of Digestion, Circulation, Respiration, and Secretion, are performed in the lower classes of animals, and the duty assigned to each part of the structure in the performance of these functions. It unfolds to our contemplation the inexhaustible resources of Nature in the propagation of the species, from the simple fissiparous generation of Animalcules, or the almost equally simple gemmiparous mode of Zoophytes, to the highly complicated viviparous birth of Quadrupeds. In thus investigating the various functions of the animal economy, in all their different stages of simplicity and complication, it determines the true nature of animal life, and discovers the characteristic properties which distinguish animals from the beings belonging to the Vegetable and Mineral Kingdoms. And by the successful applications of the principles of chemical and mechanical science to the explanation of their complicated functions, it shows that, notwithstanding the disturbing forces of the animal economy, which have hitherto defied all attempts at generalization, the true solution of all vital phenomena and the laws of organized beings are to be looked for in those magnificent arrangements which embrace the whole system of the visible universe.

The term Zoology (derived from the Greek words ζωον *an animal*, and λογος *a discourse*,) has long been applied to that branch of Natural History which treats of animals. It chiefly considers animals in their entire and living state, and describes their external forms and distinguishing characters, the history of their life, and the principles of their scientific arrangement. It points out the various external appearances presented by animals, and the changes they undergo at particular seasons of the year, or at different periods of life. It examines the kind of food on which they naturally subsist, and the abodes which they frequent, whether in the interior or on the sur-

face of the earth, or in the atmosphere, or in the waters which encompass the globe. It makes us acquainted with the remarkable instincts and habits which characterise the different species, the climates they inhabit, the extent of their geographical distribution, and the varieties of form and character which they exhibit in different regions of the earth. It describes the periodical or occasional migrations of the different species; their comparative numbers and longevity; their periods of torpidity and hybernation; their seasons of moulting, pairing, and propagating; their periods of gestation; their cares for the preservation of the infant progeny; the means employed to distribute the species over the globe; and the purposes they appear destined to serve in the economy of Nature.

This science enquires into the origin and duration of entire species, and the causes which operate towards their increase or their gradual extinction; the laws which regulate their distribution, and the changes they undergo by the influence of climate, domestication, and other external circumstances. It acquaints us with the uses of animals and of animal substances, in Medicine, Agriculture, Domestic Economy, and various arts; and the means of rearing and domesticating useful species, so as to increase their numbers, improve their breed, or extend their advantages more widely to mankind; and it likewise points out the most approved methods of preserving and preparing animals, dead or alive, for museums, menageries, transportation, microscopical or zootomical observation, and other purposes of science, utility, or recreation.

It investigates the characters and relations of the extinct races of animals, the remains of which are found every where imbedded in the crust of the earth; and thus enables us to read, in their imperfect and mutilated remains, the history of the former inhabitants of this globe. It points out to us the order followed in the successive creation of animals, as discovered by their fossil remains, their degree of organization, and their relations to the strata of

the earth, and unfolds the nature of those remarkable revolutions which have repeatedly taken place in the Animal Kingdom, in consequence of sudden or gradual changes in the condition of the surface of this globe.

The study of these various objects forms a vast and interesting department of knowledge, which is intimately connected with the most common wants and enjoyments of man, and forms a subject of contemplation peculiarly calculated to gratify, improve, and elevate the human mind; to extend its acquaintance with the sources of happiness immediately around us; to store it with useful and practical knowledge; to enlarge our views of the wonderful harmony which everywhere pervades the economy of the universe; to exalt our conceptions of the infinite wisdom, power, and goodness of the great Author of Nature, as displayed in his minutest works; and thus to lay the most rational and lasting foundations of piety and virtue, and strengthen the best principles of morality and religion.

The Animal Kingdom, which forms the exclusive subject of our study in this place, is by far the greatest of the three kingdoms of natural bodies, in regard to the number of distinct species which it comprehends; and these possess a more complicated and perfect mechanism, exhibit a more interesting series of phenomena, and have a closer relation to the necessities and enjoyments of man, than minerals or plants. Man himself, and all the beings that, like him, enjoy life, motion and feeling, are comprehended in this great division of natural bodies.

More than a thousand species of Quadrupeds have been described in zoological works, five thousand species of Birds, and as many species of Fishes, are now known to naturalists. The number and variety of Reptiles is immense; but as the greater part live in the most concealed situations in tropical deserts, in marshes, heaths, and rivers, and as many of them are armed with the most deadly poison; this class of animals has been a less favourite object of study, fewer of them are known, and they still

present to the enterprising naturalist a rich field of interesting and important investigation. The species of Shell-fish or Testacea, Crustaceous Animals, Worms, Radiated Animals, and Zoophytes, which almost cover the bottom of the vast abyss, exceed all calculation. The forms of Animacules vary in almost every infusion of vegetable or animal matter, which nature presents, or art can form. Nine hundred species of intestinal Worms have already been extracted from the bodies of animals, although comparatively little of the attention of naturalists has hitherto been directed to this extraordinary tribe of beings. The beautiful forms and colours of Insects, their interesting habits and economy, their extraordinary abundance and the facility of obtaining them, their singular metamorphoses, their importance to mankind and in the economy of nature, have long rendered this class a more popular and attractive object of study, and a hundred thousand species of these animals are now known to naturalists, a number which exceeds that of the Vegetable and Mineral Kingdoms taken together.

The number of individuals belonging to the Animal Kingdom, is not less remarkable than the varieties of their form; notwithstanding the many obstacles to their increase, from the constant warfare between the different species, from disease, accident, the changes of season, and the destructive ravages of man. The weakness of herbivorous Quadrupeds, induces them to congregate for protection in large flocks, which cover extensive tracts of country, both in the Old and New World: as the deer, the sheep, the ox, the rabbit, the hare, the paca, and many others. The numbers are still greater in the class of Birds, where the vast flocks sometimes darken the heavens like an eclipse: as in the wild pigeons of America, crows, gulls, &c. The number of Fishes which people the vast expanse of the ocean may be judged of from the immense shoals of individual species we frequently observe assembled together; as of the cod, the herring, and many other species; or from the

number of ova they produce at every period of spawning; upwards of 200,000 ova, for example, have been counted in the spawn of a single carp, and more than 1,000,000, in that of the flounder. We frequently find our coasts covered, for miles of extent, with a continuous and dense layer of conchiferous or cirrhipedous animals, in a living state, as with the muscle, the oyster, the barnacle; and their *debris* accumulated, and thrown up by tides and currents of the sea, form hills of shells, or are collected into extensive beds, of some hundred feet in depth. The distinguished Italian naturalist and traveller Donati found the bottom of the Adriatic to be composed of a compact bed of shells not less than a hundred feet in thickness. These animals are infinitely more abundant on the tropical shores of the New World, and the vast deposits of them found in the interior of the earth, show how extensively they peopled the ancient seas. Myriads of Mollusca and Conchifera live even beneath the sands of the sea, as the *Cardium*, the *Mactra*, the *Solen*, the *Mya* and the *Natica;* and the interior of the rocky strata are peopled with living tribes of lithophagous animals; as the *Pholas*, the *Teredo*, the *Petricola* and the *Saxicava*. The moving hills of ants, the countries laid waste by locusts, and the clouds of insects often observed, afford some idea of the immense number of individuals which compose the species of this class. Many Radiated Animals, as *Medusæ*, *Actiniæ*, and *Asteriæ*, are so numerous, that their carcasses, accumulated on the shores of the sea, are employed to manure the adjacent countries; their abundance often changes the colour of vast tracts of the ocean, or covers it with a sheet of fire. The bottom of the vast abyss is nearly paved with Zoophytes, which, in the Southern Hemisphere, rise up from great depths to form extensive reefs and islands. Every drop of the ocean, from the one Pole to the other, teems with animalcules, and Nature has amply provided for all their wants and enjoyments.

The various classes of animals spread over the globe, whe-

ther inhabitants of the dry land, or of lakes and rivers, or of the atmosphere, or dispersed through the boundless deep, find, in the rich and varied clothing of organic matter covering the nakedness of the earth, sufficient nourishment, not only for their own subsistence and growth, and for the continuance and increase of their species, but likewise sufficient to enable each individual to support various tribes of parasitic inhabitants. Innumerable species of Insects, *Arachnida*, and *Annelides*, move to and fro, on the surface of their bodies, feeding on the excreted matters of the skin, or sucking the vital fluids from the interior. Various kinds of *ova* are deposited, matured, and hatched under the skin, although the animals they contain are not destined to a parasitic life. Numerous species of Worms live and propagate, imbedded in the muscular and cellular tissues, in the internal cavities and vessels, and in the parenchymatous substance, even of the best protected organs of the body ; as in the substance of the liver, the spleen, the kidneys, and the brain itself. And various fluids and secretions of the living system contain myriads of *Infusoria*, whose singular forms, phenomena, and modes of generation have been attentively examined and recorded by naturalists.

Every region of the globe presents distinct species of animals : the animals of America differ from those of Europe ; those of Europe, differ from the species of Africa and Asia ; and the species of New Holland, differ from those of all the other continents of the earth. Every part of the ocean, every lake and river, and every species of plant on the earth, has its particular animated inhabitants. The trees of the forest may be distinguished by the insects that inhabit them, as animals are known by their parasitic worms and *epizoariæ*. From the Mole, the Beaver, the Rabbit, the Paca, that burrow in the earth, or the worms and insect that people its dunnest caverns, to the Chamois, the Deer, the Buctin, that bound along the snow-clad summits of the mountains—from the Zoophytes and Radi-

ated Animals that line the deepest submarine caves, or the lithophagous tribes that dig their habitation in the rocks at the bottom of the sea, to the Eagles that soar above the clouds — from the Walrus, the Seal, the Bear, that people the dreary regions of the frigid Zone, or the gigantic Cetacca that gambol beneath the ices of the Poles, to the ferocious feline tribes that range the sandy deserts of the burning Zone—the Animal Kingdom is distributed over every portion of this planet. Every element, and every situation where life could exist, is crowded with animated beings, which, like ourselves, have their feelings, their wants, and their enjoyments.

In this vast host of living beings, which all start into existence, vanish, and are renewed, in swift succession, like the shadows of the clouds in a summer's day, each species has its peculiar form, structure, properties, and habits, adapted to its situation; which serve to distinguish it from every other species, and each individual has its destined purpose in the economy of nature. Individuals appear and disappear in rapid succession upon the earth, and entire species of animals have their limited duration, which is but a moment, compared with the antiquity of the globe. Numberless species, and even entire *genera* and tribes of animals, the links which once connected the existing races, have long since begun and finished their career, and their former existence can now only be recognized by their skeletons, embalmed in the soft superficial strata of the earth, or by their casts preserved in the more solid rocks. Of the single genus of shells, called *Ammonites*, for example, upwards of three hundred fossil species have been described; and, of these, a hundred species belong to our own soil; yet, not a single individual, in a living state, is now found to inhabit the waters of the globe. Almost every stratum, composing the crust of the globe, from the newest alluvial deposits to the oldest transition rocks, abounds with the fossil relics of all the different classes of the Animal Kingdom, from whose remains,

often mutilated, imperfect, or extraordinary in their forms, the Zoologist must learn to decypher the history of the species. A new and boundless field of inquiry is thus laid open to his investigation, in the study of the characters and relations of Fossil Animals—a study highly interesting to the Physiologist, as pointing out the successive creation of animal forms, and the changes which organization has experienced since the first appearance of animals upon this earth, and essential to the Geologist, as determining the comparative antiquity and the identity of strata, and as unfolding the nature of those terrible events that have repeatedly broken up the surface of this planet, raising the inhabitants of the sea to the summits of lofty mountains, and sinking extensive forests with all their animated inhabitants beneath the bed of the ocean.

The study of the animal kingdom forms an important branch of Natural History, or that science which treats of the properties and relations of all the natural bodies which can be considered as proper objects of human investigation; and it is intimately connected, not only with all the other branches of that extensive department of knowledge, but likewise with various branches of Medicine, Chemistry, Agriculture, and other sciences and arts.

The material substances every where surrounding us, and which form the objects of Natural History, are continually acting, directly or indirectly, on our bodily frame, and, through its medium, on our consciousness. To their incessant operation, indeed, we owe the continuance of our existence, and all the enjoyments and pains with which it is replete. The external form of the different parts of our body, and all our organs of sense, relate to the properties of the objects around us. The structure of our internal organs, and every faculty and instinct we possess, have an intimate relation to the objects of the external world. The elaborate mechanism of the eye would have been useless without light, the ear without the vibrations of the air, and the delicate structure of the organ of smell without the

odorous emanations of external bodies. We have continually recourse to external objects to supply the necessities of the body, to repair its losses, and to remedy the injuries it sustains. We ascribe to impressions received from them all the sensations, ideas, or states of the consciousness, which form the first elements of our knowledge, and the materials of all our most complex mental operations. They administer to all the wants of the body, to the pleasures of sense, and to the most refined intellectual enjoyments; so that, in our present state of being, the objects of the material world are intimately connected even with our intellectual existence, with all our instincts and passions, and with every internal feeling of pleasure or of pain.

These objects, however, are very differently related to us by their natural properties; some are indifferent to us with regard to pleasure or pain, or to the wants of our body; others are productive of agreeable sensations, or are essential to our existence; and others, by their noxious qualities, are injurious or destructive to our nature, and require to be carefully distinguished and avoided. The study, therefore, of the distinguishing properties, and the various relations of natural bodies, forms a most suitable and important occupation of the human mind.

By means of our senses we are admitted to an acquaintance with the external world, and are enabled to distinguish, by their sensible qualities, the objects which we ought to pursue, from those which are unsuitable to our nature. The descriptions of Natural History, both with relation to the organic and inorganic kingdoms, relate to the sensible qualities of bodies; and there is this great satisfaction attending all their details, that they are founded on observation and experience, and their evidence rests on the established laws of thought. The description of a natural body consists in an enumeration of its various properties, whether ascertained by simple observation, or discovered by the aid of experiment, which is only a more refined mode of observation. By the ordinary laws of asso-

ciation, our perceptions are grouped together, to form that assemblage of properties we ascribe to external bodies. And although we have no means of ever discovering any connexion or relation between the immediate objects of our consciousness and the beings to which we refer them, we use the descriptive terms *red*, *green*, *warm*, *cold*, *sweet*, *bitter*, and many others, without the least ambiguity or impropriety, to express the qualities of bodies. It is obvious, however, that they express only sensations, which, without mind, could have no existence in the universe. The existence or non-existence of a substratum connecting the supposed qualities of bodies, cannot therefore affect the propriety of the language employed in Natural History, or the accuracy of its descriptions, which, provided they correspond with all the ideas produced by the objects described, will be equally true, whether the objects be in their essence spiritual or material.

The definite descriptions which Natural History requires, are applicable only to a small portion of the visible universe. The vast distances of the celestial bodies preclude all scientific examination of the materials of which they are composed, and the Naturalist merely determines the influence they exert on animate and inanimate beings. Their relations to each other, and the grand and interesting phenomena they exhibit, their magnitudes and distances, and the laws which regulate their stupendous movements, belong to the sublime science of Astronomy. The atmosphere surrounding this earth, the waters which cover so large a portion of its surface, the solid materials of which the globe is composed, and the innumerable organic productions which clothe its surface, are the objects which the natural historian examines and describes.

A knowledge of the composition, properties, and phenomena of the Atmosphere, throws much light on the history and functions of animals, as this fluid is the great medium through which oxygen, heat, light, electricity, and all imponderable agents, the great springs of vital phenomena, are conveyed to organized beings. It unfolds

to us the theory of respiration in all terrestrial and aquatic Animals, and shows the cause of the variety of temperature in the warm and cold-blooded classes. It explains to us the migrations of Animals, the theory of their geographical distribution, and many of their instincts and habits. It illustrates the periodical changes in the plumage of Birds and the furs of Quadrupeds, and the distribution of colours over the animal world. The Atmosphere is the medium by which *sounds* and *odours* are transmitted to sensitive beings, and it is intimately connected with *irritability*, the most general and the most inexplicable property of animal matter. This fluid is indeed the most essential of all the elements to the continuance of animal life, and is abundantly supplied to every individual from the summits of the highest mountains to the greatest depths of the sea.

The Waters of the earth cover three-fourths of its surface, and support a thousand times more animated beings than people the atmosphere or the dry land. The ocean covers vast plains, deep valleys and caverns, stupendous mountains, and precipices, rapid gulfs and whirlpools; a rich and dense vegetation, a world of animals, and all the other natural scenery presented by the exposed continents. It is the great oxydizing principle of the metallic nucleus of the globe, the pabulum of volcanic fires, the source of earthquakes, and the most powerful agent in the changes continually going on in the interior and on the surface of the earth. It gives off the materials of clouds, rain, snow, and hail, which give origin to springs, rivers, lakes, glaciers, icebergs, and many grand and interesting appearances of nature. Water is the nourishment of the Vegetable Kingdom, and is necessary to the support of most animals. A knowledge of that branch of Natural History which treats of the waters of the globe, is important to the Zoologist, as explaining the physical and geographical distribution, and the habits of aquatic animals. It accounts for the showers of animals that frequently fall from the atmosphere, as of fishes, frogs, shells, worms, &c. The

ova of Zoophytes are not, like those of fishes, fixed by the parent in a situation favourable for their developement, but are committed, like the seeds of marine plants, to the mercy of the waves, so that their distribution is regulated chiefly by the currents and motions of the sea, which Hydrography points out. The immense body of heated waters borne by the gulf stream through the Atlantic from the Equator towards the Arctic seas, conveys with it into high latitudes the temperature of tropical seas—a circumstance which enables us to account for the occurrence of animals along its course in latitudes far beyond their natural climate.

The study of the Animal Kingdom is inseparably connected with the science of Geology. No useful information respecting fossil animals can be learned or communicated without some acquaintance with the strata in which they occur, and with the general structure of the crust of the earth. And the successful study of extraneous fossils requires a very extensive acquaintance with the structure and character of the existing races, the nature and history of extinct animals being determined chiefly by a comparison with allied existing species. It is by finding accumulations of organic remains, spread over strata deep in the earth, and which must have once lived upon its surface, that the Geologist has discovered that the crust of this globe must have undergone very great changes in the course of ages, and that it must have exhibited many a rich and varied surface, crowded with animated inhabitants, long anterior to the existence of the busy scene we now contemplate and enjoy. Anterior to the formation of the transition rocks, there appear to have been no animals upon this earth; and during the formation of all the transition and secondary strata, the animals that existed were almost all marine, which shows that these strata were mostly of marine origin, and that animal life originated and was developed in the bosom of the deep. Besides pointing out the order of succession in the formation of the

strata, and their mode of formation by quiet deposition from a fluid, which alone could have preserved the delicate structure of the enclosed relics, these remains of animals show what must have been the nature of the situation where we now find them, at the period of their deposition; whether it formed the bottom of a fresh-water lake, or the submerged surface of a peopled continent, or the bed of a primeval sea; and many strata of the earth are characterized by the particular species of fossil animals they contain. By thus pointing out the extensive and terrible catastrophes to which the Animal Kingdom has often been subjected, we are enabled to perceive a cause of the many apparent interruptions in the chain of existing species.

As the knowledge of Mountain Rocks is founded on an accurate acquaintance with the characters and properties of simple Minerals, the study of Mineralogy is intimately connected with that of Organic Remains, and a previous acquaintance with the practical details of this branch of Natural History will greatly facilitate the most intricate and obscure paths of the Zoologist. He is often unable to obtain any information as to the geological situation of the fossil animals presented to his inspection, and must judge from the nature of the petrifying substances, both concerning the mineral strata in which they were imbedded, and the nature of the countries in which they were found. The flinty *Echini* most generally indicate the chalk formation—a formation which we observe to form low and flat districts on the east coast of England. *Encrinites* mineralized with calcareous spar, we most frequently find in the limestones of the coal formation, which form low and fertile countries, varied only by gentle elevations of the strata, or interrupted by abrupt projections of trap rocks. The external aspect of the skeletons of *Fishes*, from the Paris gypsum formation, is very different from that of the fresh-water fishes of the bituminous marl-slate, independent of their zoological characters.

The branches of Natural History we have hitherto men-

tioned, as connected with or illustrative of Zoology, refer to bodies of a simple composition, and whose phenomena, depending on the ordinary affinities of matter, exerted at insensible or at perceptible distances, admit of rigorous explanation on chemical principles, or are regulated by the laws of mechanical philosophy. The composition of organized bodies is more complex: they assume more regular and determinate forms, the affinities of their component elements are more nicely balanced, and they exhibit a series of phenomena, for a definite period, too complicated to be explained in the present state of science, either on the principles of Chemistry or Mechanics. From numerous experiments, Naturalists have been led to believe that the simplest organized bodies, as *Monads* and *Globulinæ*, originate spontaneously from matter in a fluid state, and that these simple bodies, of spontaneous origin, are the same with the gelatinous globules which compose the soft parts of Animals and Plants. Many of the phenomena of Plants, as the absorption of moisture by their roots, the respiration of the leaves, their turning in the direction of the sun, and the passage of fluids through their inert tubes, are dependant on the common laws of inorganic matter; and in the Animal Kingdom the same laws operate in the formation of the silicious cristals, which compose the skeleton of many Zoophytes, and the calcareous crystals of many Radiated Animals, as the *Asterias* and *Echinus*. This, however, does not affect the great characters which distinguish organized from inorganic bodies, and the Vegetable from the Animal Kingdom.

Organic bodies have an arrangement of internal parts adapted for the transmission of fluids through every part of their structure, which enables them to grow by a process of internal developement. They subsist on fluids, which in vegetables are sucked up by external filaments or roots from the soil in which they are fixed, or by their whole external surface as in Hydrophytes; and in animals the fluid aliment is absorbed from an internal reservoir

or stomach, by ramified vessels, like internal roots, or it transudes through the surface of their body, as in those animalcules which have no internal cavity. The chemical composition and the whole organization of vegetable bodies are more simple than those of animals, and their phenomena are more obviously dependent on physical laws. Their analogies, therefore, with the mechanism and functions of the human body are very remote, and the science of Botany, which forms an important branch of the healing art, owes its high importance and attractions to circumstances totally different from those close analogies, which connect the study of animals, with the practice and pursuits of medical science.

The elegant forms and delicate structure of Plants, the beauty and harmony of their colours, and the fragrant odours they exhale, the refreshing verdure, and the richness which they spread over the face of nature, the delicious fruits they yield, and the raiment and shelter they afford, the support they yield to the animal world, their various medicinal virtues, and their numerous useful applications in domestic economy and the arts, have long rendered this branch of Natural History a popular and favourite object of study. Plants afford hemp, cotton, flax, and many other articles employed in forming clothing. Wood, of all natural substances, is the most extensively employed in the arts; it forms the framework of cities; and fleets, which are bulwarks of empires, and convey population and the productions of commerce over the globe, are built of it. Opium, Camphor, Squills, Belladonna, Chincona, Jalap, Fox-glove, Ipecacuan, Rhubarb, and many other of the most active remedies employed in medicine, are derived from Plants: they yield also many of the most common articles of food, and the most favourite dainties of the table. Spirits, wines, and the various products of fermentation, are derived from vegetable substances. There are few plants which do not afford sustenance to some kind of animals, and as they

grow by absorbing inorganic matter, they are a kind of laboratory, in which matter is organized to suit it for the digestive organs of animals. Many plants which are poisonous to one kind of animals, are the proper food of another kind. Numerous species of insects reside and subsist only on particular species of the Vegetable Kingdom, and most of the feathered inhabitants of the air select the seeds and fruits of particular Plants. The forests of marine plants at the bottom of the sea, are covered with animated inhabitants, which depend on them for subsistence, or cling to them as points of support. The Animal and Vegetable Kingdoms are so intimately blended at their origins, that Naturalists are at present divided in opinion as to the kingdom to which many well-known substances belong—as the *Codium tomentosum*, *Alcyonium bursa*, the *Corallina officinalis*, *rubra*, and *opuntia*, *Dichotomariæ*, *Tremellæ*, *Globulinæ*, &c. Several organized bodies, as *Oscillatoriæ*, *Confervæ*, and *Monades*, which have neither roots, nor capillary vessels, nor a digestive stomach, nor other distinct organs of plants or animals, connect the Vegetable and Animal Kingdoms by imperceptible gradations. Many Plants, as the *Cistus helianthemum*, *Hedysarum gyrans*, *Mimosa pudica*, and *Berberis vulgaris*, exhibit motions similar to those which we ascribe to irritability in animals. The study of the almost mechanical functions of Plants, enables us better to comprehend the mechanism of the complicated functions of animals. An acquaintance with the species of Plants is indispensable to the Entomologist, and is necessary to the successful study of Ornithology. When we consider, indeed, the importance of a knowledge of Plants in the domestication of useful animals, in the rearing of foreign and domestic species, and in illustrating the history and economy of most animals, we find that an acquaintance with the Vegetable Kingdom is calculated to facilitate the path of the Zoologist in every department of his investigations.

In the infancy of Botany it was pursued only by medi-

cal men, and with a view to the medicinal virtues of plants. The numerous useful applications and the extended relations of the science, however, in modern times, have raised this interesting study to a high rank in the scale of human knowledge; and by the zeal and industry of its cultivators in all parts of the earth, nearly seventy thousand species of Plants have been discovered and characterized. The study of the Vegetable Kingdom is an inexhaustible source of innocent and rational recreation, has given rise to the most brilliant and useful productions of human genius, and has long been an independent branch of academical instruction in most of the Universities of Europe.

17 Although the study of the Animal Kingdom has not met with the same fostering care in the Universities of Britain, it embraces the consideration of a series of beings, whose relations to the wants and comforts of man, are not less numerous and important than those of Plants, and it has long been cultivated with advantage and success in the Universities of France, Italy, and Germany. Whether, indeed, we consider Animals as affording to man materials for the maintenance and growth of the body, or medicines to prevent, alleviate, or remove its diseases, or clothing to protect his frame against the vicissitudes of temperature, and the inclemencies of the seasons, or physical power to aid him in the operations of art, or protection against the attacks and depredations of foes, or ornaments to please and cultivate his taste, or luxuries to gratify the sense, or knowledge extensively applicable to his necessities and enjoyments, or an endless source of intellectual amusement and gratification, their study forms a department of knowledge which yields to no other in its immediate importance to the existence and happiness of man.

18 The form and disposition of the human teeth, the structure of the digestive organs, the natural instincts and appetites, and the results of constant and universal experience, show that man was designed to subsist partly on animal flesh; and almost every class of animals supplies him with

abundant and wholesome food. The whole class of Quadrupeds, and almost every part of their body, the muscles, the brain and spinal cord, the lungs, the heart, the stomach and intestines, the liver and pancreas, the kidneys, the uterus, the placenta and udder, the skin, the fat, the marrow and gelatinous substance of the bones, the blood, and the milk, are used as alimentary substances. All the species of Birds, and their eggs, afford a wholesome nutriment to man, and even their nests are sometimes used as articles of food. The flesh and the eggs of many species of Reptiles, form also esteemed and highly nutritious articles of food. Several kinds of turtles, as the *Testudo ferox*, Lin. which abounds in the rivers of South America; the *Testudo Græca*, an inhabitant of Africa and Sardinia; the *Testudo squamata* of Java; and the *Testudo Europea*, which is the species most abundantly distributed over the southern countries of Europe, are prized as dainties of the table. Some species of the lizard tribe are also used as food. Both the flesh and eggs of the *Iguana* are eaten. Some species of the viper are prepared as food, and several kinds of frogs are in common use on the Continent, as delicate articles for the table. Nearly the whole class of Fishes are employed as articles of food for man, and in many parts of the globe they form almost the entire support of extensive populations. Sometimes, however, particular species acquire noxious qualities, either from the kind of food on which they have subsisted, or from some diseased state of their organs. The whole of their muscular system is eaten, which forms the greater part of their bulk; and in some species, the skin, the ovaria, the swimming-bag, the testicles, and the liver, are also used. Many of the smaller species of fishes are eaten entire. On the coasts of Lapland, Siberia, and the western parts of Africa, many rude tribes make bread of dried or pounded fishes. Most of the marine and fresh-water Molluscous and Conchiferous Animals afford a wholesome and palatable food, and are very extensively used by those who inhabit the shores of the sea;

the cuttle-fish, the oyster, the mussel, the clam, the cockle, the whelk, the limpet, and the snail, are among those in common use. The Romans were supplied with oysters from the British coasts. Numerous Crustacea, as all the larger species of crabs and lobsters, the prawn, the shrimp, &c., are extensively employed as articles of diet, and as a highly flavoured condiment to more substantial aliment. Even the classes of Insects, Tunicata, and Radiata, supply articles of nutriment to man; the locust is extensively used as an article of food, the honey of the bee, some species of *ascidiæ* and *actiniæ*, and the ovaria of the *Echinus esculentus* are also employed.

Many Animals which feed on substances obnoxious to us, afford, notwithstanding, a wholesome nourishment. Numerous insectivorous Quadrupeds subsist entirely on the most loathsome and indigestible insects and worms. Birds, which feed on the most poisonous reptiles and insects, yet afford a wholesome flesh; and crabs, which feed on the most putrid carcasses of fishes, yet yield a highly palatable nutriment. There is so close a chain of connection and dependence between all the different classes of the Animal Kingdom, that even the lowest may be said to contribute, though indirectly, to the sustenance of man. Animalcules are the food of Zoophytes, which, in their turn, are consumed by Radiated Animals and worms; these are devoured by Crustaceous and Molluscous animals, which serve as the food of Fishes; and Fishes, which are born to a constant warfare, feed on each other, or are pursued by the amphibious and cetaceous Quadrupeds which inhabit the deep, or are seized by the clouds of birds which watch their motions from above, or they are dragged from their secret recesses by the artifice of man. The different classes of Animals generally subsist on those beneath them in the scale of being, or they derive their support from the Vegetable Kingdom, so that matter is perpetually advancing to higher states of organization.

An acquaintance with the composition, and the degree

of digestibility of alimentary substances derived from the various classes of the Animal Kingdom, would prove an important acquisition to medical science. It would greatly extend the powers of the practitioner, by enabling him to derive from animal substances, nutriment adapted to the various states of the digestive organs, in health, convalescence, debility, or disease. Thus, in the class of Quadrupeds, the muscular parts, which consist chiefly of fibrine, with a little gelatine and osmazome, are the most nutritious; the brain and the glandular parts, which are composed chiefly of coagulated albumen, are less nutritious; and the tendons, ligaments, and membranous parts, which consist principally of a condensed gelatine, afford the weakest nourishment.

The Animal Kingdom not only presents an inexhaustible supply, and an endless variety of wholesome food, adapted to every state of the constitution, to every taste and idiosyncrasy, to every age, sex, and climate, but likewise affords many of the most useful and powerful remedies employed in the treatment of disease.

Castor, a powerful antispasmodic medicine, employed in hysteric affections, is a secretion of two glandular sacs, which terminate at the prepuce of the Beaver.

The well-known powerful aromatic substance, *Musk*, which is extensively used in epilepsy, hysteria, and other spasmodic diseases, is obtained from two glandular sacs placed before the prepuce of the *Moschus moschiferus*, an animal like a small goat, which inhabits the most dreary, rocky summits of the high mountains of India, China, Thibet, and other countries in the east of Asia.

Spermaceti, which is used internally in catarrh and gonorrhœa, and externally in ointments to wounds and excoriations of the skin, is procured from an unctuous matter, filling numerous cartilaginous cavities on the upper part of the head of the Cachalot, a cetaceous animal as large as a whale, which abounds in various parts of the South Sea. The highly esteemed odoriferous *Ambergris* is

an induration of feculent matter found in the large intestine of this animal in a state of disease.

The crustaceous coverings of *Crabs*, which consist of the carbonate and phosphate of lime, and certain concretions of a similar composition, found in their stomach, have long been employed as medicines to remove acidity of the digestive organs. And various other calcareous substances, derived from the Animal Kingdom, as the burnt shells of the common *oyster*, the egg-shells of the domestic fowl, and the *Corallina officinalis*, have been extensively employed in medicine as antacids. These earthy products of organization, when levigated and washed with water, afford a calcareous powder, more free from silicious particles, or other impurities, than any other form of the carbonate of lime. In the article sold by the apothecaries of France, under the name of the *Corallina officinalis*, Lamouroux detected more than a hundred distinct species of calcareous Zoophytes, which shows how extensively this class of animals is capable of contributing to the articles of the Materia Medica.

Other Zoophytes, containing *Iodine*, have been employed with great success in the cure of bronchocele, and in the removal of chronic glandular tumors, particularly in Savoy, Switzerland, and other mountainous districts of the Continent, and are recommended in all the British pharmacopœias.

The horns of the *Deer*, when filed down and boiled in water, afford a transparent, colourless, and inodorous jelly, which is advantageously employed internally, as a demulcent, in dysentery and diarrhœa, and as a light nutritive article of diet for convalescents. The burnt horns of this animal, from the quantity of phosphate of lime they contain, have been used with much success in rickets and *mollities ossium*.

The *Phosphate of Soda*, used in medicine as a cathartic, is procured by a complicated process from the burnt bones of Quadrupeds. And *Phosphoric Acid*, which enters ex-

tensively into chemical compounds, and from which that remarkably inflammable substance, Phosphorus, is obtained, is procured by a chemical process from animal substances. *Empyreumatic animal oil*, an antispasmodic, is obtained, by distillation, from the bones and horns of animals.

The basis of Sal Ammoniac, or *Muriate of Ammonia*, which is used internally as a diuretic and diaphoretic, and externally as a discutient to indolent tumors, is procured by distillation from the urine and bones of animals. From the quantity of *ammonia* disengaged during the combustion of animal substances, the ammoniacal odour is frequently adopted as a test of the animal nature of doubtful organized bodies.

Isinglass, (which consists of the dried coats of the swimming bag of the sturgeon, and several other cartilaginous fishes,) the *adipose substance* of the common hog, and the *wax* and *honey* of the bee, are extensively used for medical and pharmaceutic purposes. And *Prussic Acid*, the most powerful of all narcotic substances hitherto discovered, is obtained from animal matter in a state of putrification.

Scarcely any article employed in medicine or surgery is more extensively beneficial than the *Spanish Fly (Cantharis vesicatoria)*, both from its external and internal action on the living body. These beautiful, shining, green-coloured insects, swarm in the forests on the southern shores of Europe, feeding on the leaves of the ash and the elder tree, and spread a strong and unpleasant odour around them. Although some insectivorous Quadrupeds, as the hedgehog, can eat large quantities of them with impunity, their corrosive action on the human system is so great that they frequently inflame and excoriate the hands of those who are incautious in collecting them; and on this corrosive property their chief medicinal virtue depends. In cases of violent visceral inflammation, the external use of *Cantharides*, as rubifacients or vesicatories, cannot be

supplied by any other medicine. They create a powerful determination to the surface, and cause a copious effusion of the serous part of the blood, by which the internal action is relieved. They have so remarkable a determination to the urinary organs, that strangury is sometimes occasioned by their external use; and when administered internally, they sometimes act so violently on the kidneys and bladder, as to induce inflammation of these organs, and a discharge of blood. From this tendency to excite the urinary organs, they are employed in various diseases connected with debility of the urinary and genetal systems, and likewise as a diuretic in dropsy.

The *Leech* has been employed in blood-letting for more than two thousand years; its medical application is described by Themison, who wrote before Celsus and Galen, in the time of Augustus. Its use is likewise described by Pliny, and is celebrated in the lines of Horace.

This small simple vermiform *Annelide* has a dark colour and forbidding aspect, and inhabits the foul stagnant marshes and pools of fresh water throughout Europe. It perforates the skin of animals by its three sharp teeth, and by a constant sucking from the wound it fills its body with their blood. From the smallness and superficial nature of their wound, the mildness and safety of their operation, the facility of regulating the quantity of blood they extract, and the local nature of the depletion, they are in most inflammatory affections more convenient and efficacious than the lancet, much safer in their operation, and, in many cases, nothing could supply their place.

I shall not here make any allusion to the innumerable applications of animals and animal substances to the cure of disease, recorded in the writings of the ancients, founded for the most part on superstitious notions or on virtues altogether imaginary, and which the more scientific principles of modern medicine have entirely discarded from practice. They will be found recorded in the Natural

History of Pliny, or scattered through the writings of Hippocrates, Galen, Dioscorides, Avicenna, and other Greek and Arabian physicians.

Man, though the most naked, helpless, and delicate of animals, is the most extensively distributed over the globe, and enjoys health and vigour in the torrid, temperate, and frigid Zones, from the 74th degree of North Latitude, to the 56th degree South of the Equator. Without fur, feathers, scales, shells, or other natural covering, he is enabled to endure the most opposite extremes of climate by the remarkably accommodating power of his constitution, and by his superior sagacity in devising artificial means to defend his frame against all the vicissitudes of the seasons, and the varieties of climate. He covers the nakedness of of his body with spoils from almost every class of animals. The wool, the furs, and the skins of Quadrupeds are manufactured into garments, or are worn in their natural state. The plumage of Birds, the scaly coverings of Reptiles, the skins of Crocodiles, and even of some Fishes, and the shells of the inferior tribes, are employed to cover his body. In Polar regions, where the scanty vegetation can supply him neither with clothing nor food, the periodical migrations of Quadrupeds and birds, and the great abundance of the lowest tribes of animals, more than supply all his wants. The rein-deer, the Polar-bear, the musk-bull, the wolf, and several other Quadrupeds were found by our enterprizing countrymen in the sterile and frozen solitudes of Melville Island. The Naturalist who accompanied Kotzebue, describes the waters of the Polar seas as swarming with animal life. "Medusæ and Zoophytes, Mollusca and Crustacea, innumerable species of Fishes in incredibly crowded shoals, the gigantic swimming Mammalia, whales, physeters, dolphins, morses, and seals, fill the sea and its shores; and countless flights of water-fowl rock themselves on the bosom of the ocean, and in the twilight resemble floating islands."

The productions of nature are subjected to numerous changes to suit them for administering to our wants and enjoyments: hence have arisen the various arts which occupy so large a portion of the intellectual and physical powers of man. The employment of the physical powers of the lower animals in conducting the operations of art, enables mankind to devote a larger share of intellectual energy towards their improvement, and affords a power more certain in its operation, more susceptible of every modification, more extensively applicable, and more completely under control, than any mechanical forces ever contrived by man. The employment of animals in the operations of agriculture is almost coeval with the existence of the human race. Their use is no less ancient and important in the operations of war, in travelling, hunting, conveying over land the productions of industry and commerce, and in communicating or regulating the motion of engines and machinery used in the arts, or in the common intercourse of society. The horse, the elephant, the camel, the ox, the ass, the mule, the rein-deer, the dog, the lama, and the buffalo, have long employed their physical strength in the service of mankind. Horses were as common in the armies of the Pharaohs, and at the Trojan war, as at the present day. Armed elephants were used in the Persian armies before the invasions of Alexander the Great, and were even marched into the centre of Italy. Dogs were employed by the Lydians to hunt the boars of Mount Olympus before the time of Herodotus. Regular posts were established in Persia by means of horses before the time of Xerxes. Camels were used in travelling in the days of Abraham, about 2000 years before Christ, and they were employed as beasts of burthen by the Persians in their wars against the Lydians. Cyrus gained a signal victory over the forces of Crœsus, by employing a troop of camels to frighten the horses of the Lydian prince. Hannibal struck terror into the Roman army by a night stra-

tagem, with oxen. Asses were employed by the Israelites as beasts of burthen four thousand years ago, as they are employed in the same countries, at the present time.

We employ the watchfulness of the dog, the cat, and some other domestic animals, to protect our property. We employ the strength of the elephant, and the fleetness of the horse, to defend our lives from danger. Bats, birds, and insectivorous Quadrupeds, check the ravages of insects, and protect the fruits of the field for our use. Birds and insects, by devouring the putrid carcasses of animals, check the infectious emanations, which otherwise would corrupt the air. Carnivorous Quadrupeds and rapacious Birds form a necessary restraint to the too rapid increase of the weaker tribes, which find a never-failing abundance of food in the vegetable covering of the earth.

We make use of innumerable productions of the Animal Kingdom, to ornament our person or property. The tusks of the Elephant, and of many other Quadrupeds, supply us with ivory; Reptiles yield us the tortoise-shell; Molluscous Animals the rich pearls of commerce; and Zoophytes the beautiful red coral. No art can imitate the fleece of the Tiger, or the Leopard, or the Panther, or the Beaver, or the Ermine, nor the brilliant plumage of the Humming-birds, nor the snow-white down of the Eider, nor the splendid plumes of the Ostrich and the Birds of Paradise. The lustre of the polished Nautilus, the Haliotis, the Turbo, the Ostrea, and many other shells, surpasses that of the precious metals; and no production of human industry equals the rich product of the Silk-worm. Leather, hair, bristles, parchment, bladder, catgut, feathers, quills, down, shagreen, horn, bone, whalebone, spermaceti, tallow, train-oil, wax, lac, cochineal, ivory-black, glue, China ink, mother-of-pearl, are also useful substances derived from the Animal Kingdom. Ivory and tortoise-shell are extensively used in the arts for ornamental purposes; the red coral and the sponge form valuable articles of commerce in the

East; houses and pavements are built of madrepores on the shores of the Red Sea and in the Ladrone Islands, and they are also burnt to manure the land.

We are indebted to the Animal Kingdom for the delightful and invigorating amusements of hunting, shooting, and fishing, the pleasures of falconry, and the sanguinary sports of the arena. Menageries have been the delight of princes since the collection formed by Alexander for his master Aristotle at Babylon. We feel an irresistible delight in watching the interesting habits, or in contemplating the beautiful forms and structure of the lower animals. We admire the elegance and fleetness of the horse; we view with terror the strength and fierceness of the lion and tiger; we are astonished at the magnitude of the whale, the giraffe, and the elephant; we make a companion of the dog from its attachment and fidelity; we are amused with the grotesque vocal imitations of the parrot, and the intelligent airs of the monkey; we admire the industry of the ant, the mechanical skill of the beaver, and the systematic economy of the bee; we contemplate with pleasure the soaring flight of the eagle, the immense velocity of the falcon, and the strength of the ostrich; we listen with delight to the warbling of birds, and are charmed with the melodious notes of the nightingale.

No department of science indeed is calculated to present the mind with more interesting objects of contemplation, or enrich it with more affecting imagery, than the study of animated nature. It has called forth the intellectual energies, and enriched the compositions of all the philosophers, historians, and poets of antiquity, and has been a fertile theme of the profoundest disquisitions in modern times. The writings of Moses, of Homer, Hesiod, and Oppian, of Herodotus, Plato, Xenophon, Aristotle, Diodorus, and Ælian, abound with interesting descriptions and metaphors taken from the Animal Kingdom; and indeed they constitute the most striking and affecting objects of

the works of genius in every language, in every country, and in every age. An accurate acquaintance with the forms, characters, and habits of Animals, gives energy and life to the productions of the painter, the statuary, and the sculptor; and as they constitute the chief natural riches of a country, they equally interest the navigator, the traveller, the geographer, the historian, and the legislator. They occupy a prominent part in the hieroglyphics of Egypt, the sculptures of Greece, the mosaics of ancient Rome, and in the great productions of Raphael, Michael Angelo, Canova, and other artists of modern times. The zoological traveller can never feel listlessness and fatigue, whether he traverse the sandy deserts of the torrid Zone, or the ices of the Poles, or the trackless expanse of the ocean, as, in the dreariest solitudes, every element is to him peopled with interesting objects, all proclaiming the presence and the watchful care of the Great Author of his being.

The natural philosopher, who contemplates the mechanism of animals under all their diversified forms, to discover the structure and connections of the various parts, their adaptation to the purposed ends, and the laws which regulate their complicated movements, is lost in admiration of the endless resources of Nature for the accomplishment of the same design, the regularity and simplicity of the laws which regulate the motions of living matter, and the exquisite mechanism of the parts in all their minutest details. Even in the most complicated animals he finds the solid frame-work, the skeleton and its joints, constructed according to the strictest laws of mechanics, and the muscles act in exact accordance with the principles of the lever; the functions of respiration, digestion, and nutrition, are simple chemical processes, and the various secretions of the living body are complicated products of chemical action; the nerves are a kind of galvanic wires, which establish an instantaneous communication between

the most distant parts; and the whole circulating system, with its tubes, valves, fluids, and moving powers, is a complicated hydraulic machine; the larynx, the organ of voice, is an exquisite wind instrument, and the ear is admirably constructed according to the principles of acoustics; the eye is the most perfect of optical instruments, and indeed every part of the frame is constructed according to the strictest rules of proportion, fitness, and beauty.

The study of the systematic arrangements of Zoology, or the principles according to which the innumerable species of animals spread over the globe are distributed into groups, as genera, orders, and classes, to point out more readily their mutual relations, and aid the memory in acquiring knowledge concerning them, is a kind of practical logic eminently calculated to exercise and improve our faculties of observation, perception, memory, and reason. Comparative Anatomy is a study of analysis, which discovers to us the chain of connection between all the apparently isolated facts of Zoology; it accustoms us to patient and connected inquiry; it begets a habit of minute observation and accurate discrimination; and it alone has conferred the rank of science on the study of animated nature. It has engaged the attention of the most distinguished philosophers for three thousand years; it has contributed largely to the advancement of the healing art, and to the progress of Geology, Zoology, and the philosophy of mind; and it has afforded many of the most useful and brilliant discoveries recorded in the history of science, as of the Lacteal Vessels, the Absorbent System, the Thoracic Duct, the Circulation of the Blood, and the great principle of Galvanism.

The course of instruction I mean to deliver on these two extensive branches of science will embrace an account of the structure, functions, history, and classification of existing animals, and a description of the fossil species. The lectures and demonstrations will be illustrated by an ex-

tensive series of zoological specimens, drawings, and zootomical preparations, the greater part of which are already collected and arranged. The classes, orders, and genera of every division of the Animal Kingdom will be examined, and the most useful and interesting species of each group will be selected for illustration.

After a few preliminary Lectures, detailing the objects and relations of the study of Animals, and explaining the technical language of the science, the Comparative Anatomy will occupy the first half of the course, and will comprehend the demonstration and description of the organs of motion, sensation, digestion, circulation, respiration, secretion, and generation, in all the various tribes of the lower animals. The physiological details, and the applications of the facts to Zoology, Medicine, and other sciences, will accompany the demonstrations of structure; and this part of the course will conclude with observations on the mode of conducting zootomical inquiries, and on the art of making and preserving zootomical preparations.

The Zoology will succeed the anatomical details, as all scientific arrangements of animals are founded on structure, and will be divided into two distinct departments; the first treating of existing animals, and the second of extinct species.

The history of the existing species of the Animal Kingdom will comprehend the characters, classification, habits and uses of the animals belonging to the classes, *Mammalia*, *Aves*, *Reptilia*, *Pisces*, *Mollusca*, *Conchifera*, *Cirrhipeda*, *Annelides*, *Crustacea*, *Arachnida*, *Insecta*, *Vermes*, *Tunicata*, *Radiata*, *Zoophyta*, and *Infusoria*, commencing with the natural history of the human species. This division of the course will be terminated with practical observations on the methods of collecting, preparing, transporting, and preserving zoological specimens.

The history of the known species of Fossil Aimals will be detailed in the same descending order of the classes, and

will contain an account of their distinguishing characters, their physical condition, their geological situation, their geographical distribution, and their relations to the existing species. In this part of the course, the connections of the study of Fossil Animals, with the doctrines of Physiology, will be pointed out, and also their relations to the past revolutions of the globe.

THE END.

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